METHOD FOR EXTRACTION OF PERTINENT INFORMATION TAKING INTO ACCOUNT THE OBJECTIVE AND THE TARGET

5   The present invention pertains to a method of extracting pertinent information taking into account the objective and the target.

The method of the invention applies in different contexts where a decision maker:

10   • has available a base of information which is or can be evaluated with regard to a certain number of criteria;

    • seeks to satisfy or to convince a given target, for which target the importance or the

15   pertinence of the criteria is known or can be obtained;

    • possesses an objective which is specific to him and which is or can be evaluated according to these same criteria.

20

This is the case when, for example, a decision maker has to formulate a convincing line of argument to arrive at a given conclusion, while persuading a target, that is to say that the arguments used have to

25   enable him to reach the desired conclusion, having the agreement of the audience (at least of the majority of this audience). This context corresponds to the field of "propaganda": advertising, marketing, politics, etc.

30   In this type of context, the decision maker has available an information base which is a set of facts or of events; the target is a given audience, composed of one or more people; the objective corresponds to the conclusion which the decision maker wishes to arrive at

35   by extracting pertinent facts or events from the database enabling him to construct a convincing line of argument, and the criteria used for the extraction are the values of the audience, that is to say the

elements, for example psychological, which characterize at least the majority of the audience.

There is currently no automated method making it possible to carry out such an extraction of information while taking account at one and the same time of the objective and of the target.

The subject of the present invention is a method of extracting, from an information base, facts or events which are pertinent in relation to a target and which simultaneously make it possible to attain the fixed objective.

The method in accordance with the invention is a method of extracting pertinent information from an information base taking into account the objective and the target and it is characterized in that the target and the objective are identified, that the values applicable to the target are determined and that they are weighted according to their importance in relation to the target, that each of the information items of the information base is successively examined, that the preferences or degrees of importance of each of these information items are evaluated according to at least one criterion dependent on the target, that each information item is weighted by allocating to it at least one value, that on the basis of the values thus weighted, a morphological filter, dependent on the objective and on the target, is applied to the values associated with the information of the base, that thereafter an identification of the pertinent elements of the base is effected so as to match the filtered values up with the elements of the base and that these pertinent elements are extracted.

The invention is implemented, for example, as specified hereinabove, so as to construct a line of argument enabling a decision maker to arrive at the

desired conclusion (convince an audience to vote for him, for example) while taking account of the values of the audience (the electoral topics which have the most importance for the majority of the audience), the
5   result of this being to obtain some agreement of this audience (recognize that the plan of action presented by the candidate does indeed comply with all the important topics), or at the very least of the majority of this audience.
10

The present invention will be better understood on reading the detailed description of an embodiment, taken by way of non-limiting example and illustrated by the appended drawing, in which:
15   - the single figure is a diagram illustrating the use of operators in accordance with the method of the invention.

The method of the invention will be described with
20   reference to the case of the taking of a decision relating to a group of people, but it is of course understood that the invention is not limited to this application alone, and that it may be implemented in all cases where one wishes to extract pertinent
25   information from a digitized or digitizable information base, regardless of the volume thereof, with a view to constructing a line of argument, a reasoning, a plan of action, etc.

30   The present example pertains to the case where the decision that a decision maker has to take is the selection of an alternative (one of the terms of a choice) while taking account of a number of items of information and while satisfying practically all the
35   people who are involved or affected by the decision process. In this group decision context (also referred to as "collaborative"), the information base is composed of all the available data relating to resources (hardware, people, time, etc), alternatives,

etc. The target corresponds to the people who are involved or affected by the decision process. The objective corresponds to the alternative desired by the decision maker. The criteria are the values to be taken into account so as to satisfy the target.

The method of the invention makes it possible to extract the pertinent information and/or the alternatives which would enable the decision maker to take his decision in full knowledge of the facts and whilst satisfying all parties (or the majority of them).

A main step of the invention is to construct a filter which selects a set of facts that are pertinent in regard to an objective to be attained while complying with a given target. Thus, the process of the invention has the following elements as input:

- a base of information, each item of which can be evaluated with regard to a certain number of criteria;

- a given target, for which it is possible to evaluate the importance of the information according to the criteria used;

- an objective which can also be evaluated according to these same criteria.

This filter must possess the following properties:

• If the filter is applied to an information base, BI, which contains a given set of information, BF, then the elements selected from this set BF will also be selected for the base BI.

- The result of the filter is necessarily contained in the initial base.

- Re-applying the filter serves no purpose, but it may be modified.

The present invention implements filters of morphological opening type, arising from the technology of mathematical morphology, which possess, by construction, these properties. In this regard, reference may be made to the book entitled "Morphologie mathématique" by M. SCHMITT and J. MATTIOLI published in 1994 by Editions MASSON.

The method of the invention implements such filters and comprises the following three main steps:

1. For each item of information of the base BI, we evaluate, in a numerical manner, the preferences or degrees of importance according to target - dependent criteria. A set of values is then allocated to each information item. These values are obtained by semi-automatic analysis (for example with the aid of the "MACBETH" software), by an operator, an expert, etc. Thus, for each element of the base BI, the associated weighted values are obtained.

2. A morphological filter dependent on the objective and on the target is applied to the values associated with the elements of the base BI. This filter may be, in a manner known per se, a distance or a metric, for example.

3. An identification of the elements of the base BI is made in such a way as to match the filtered values up with the elements of BI.

Thus, at the end of step 3, the whole set of information is obtained taking account of the objective and of the target, rendering the information pertinent. As appropriate, the pertinent information thus obtained is ranked by order of pertinence. Finally, a line of argument can be constructed from this information.

In the following account, we recall the definitions of the terms used during the implementation of the morphological filters and their essential properties.

Let $\Im$ be the base of facts, that is to say: $\Im = \{F \mid F \text{ identified fact}\}$.

Let $F^{\bullet}$ be the objective to be attained. We assume that $F^{\bullet} \notin \Im$, otherwise the solution of the problem is immediate.

Let Val be the valuation function $\Im \rightarrow [0,1]^n$ where n is the number of values such that $Val(F) = (v_1, \cdots, v_n)$ where v_i represents the degree of importance of the ith value corresponding to the fact F.

We write $V^{\#} = (v_1^{\#}, \cdots, v_n^{\#})$, the estimated value of the target and $V^{\bullet} = Val(F^{\bullet})$, the calculated value of the objective to be attained.

The aim here is to construct a filter which selects from $\Im$ the facts which are pertinent in regard to the objective to be attained F^{*} while complying with the target.

We firstly recall the following properties:

(1) $\forall X \subset Y, \Psi(X) \subset \Psi(Y)$,   which corresponds to monotonicity. This implies that if Ψ is applied to a base Y which contains X, then the elements selected from X will also be selected for Y.

(2) $\forall X, \Psi(X) \subset X$, which corresponds to anti-extensivity. This implies that the result of Ψ is necessarily contained in the initial base.

(3) $\forall X, \Psi \circ \Psi(X) = \Psi(X)$, which corresponds to idempotency. This implies that re-applying the operator Ψ serves no purpose.

If Ψ possesses properties (1) and (3), it is mathematically a filter and if, moreover, Ψ satisfies (2), we then speak of morphological opening. Having regard to the objective of the invention, the operator to be constructed is necessarily a morphological filter.

The invention proposes the application of an operator to $\Im$ which makes it possible to satisfy (1), (2) and (3). To do this, we construct two operators on $\mathrm{Im}(Val) = \{V \mid \exists F \in \Im, V = Val(F)\}$, which is the set of values associated with the base of facts $\Im$.

It will be noted that the function *Val* is a mapping (to each fact, a corresponding value can be calculated), but not necessarily bijective. It may happen that - for a given value, there exist two distinct facts which correspond to it.

We shall construct two filters on $\mathrm{Im}(Val)$, which are operators as defined hereinabove.

Let Ψ_1 be the filter defined by $\Psi_1(\mathrm{Im}(Val)) = \{V \in \mathrm{Im}(Val) \mid d(V, V^*) \le d(V^*, V^\#)\}$. $\Psi_1(\mathrm{Im}(Val))$ is therefore the subset of the values of distance to v^* less than or equal to the constant $d(V^*, V^\#)$, where d is a distance, for example of the form $d(x,y) = \sup_i |x_i - y_i|$ for a fine filter (strongly filtering), or $d(x,y) = \sum_i |x_i - y_i|$ for a coarse filter (weakly filtering), x and y being the values considered for these distances ($V^*, V^\#$, ...).

It follows that Ψ_1 is a morphological opening.

Let Ψ_2 be the filter defined by $\Psi_1(\text{Im}(Val)) = \left\{ V \in \text{Im}(Val) \,\middle|\, d(V, V^{\#}) \leq d(V^{*}, V^{\#}) \right\}$.
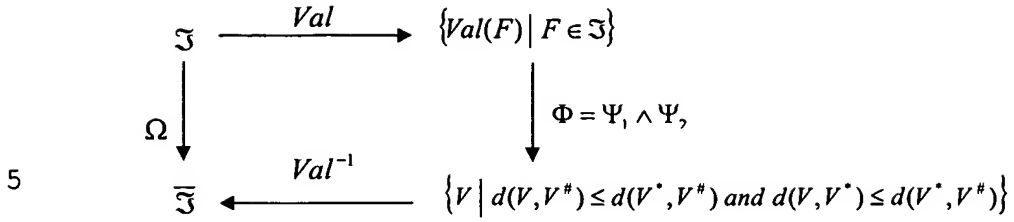
Let $\Phi = \Psi_1 \wedge \Psi_2$, that is to say: $\Phi(\text{Im}(Val)) = \Psi_1(\text{Im}(Val)) \cap \Psi_2(\text{Im}(Val))$.

This has been represented in the single figure of the drawing. In the base of facts $\Im$, we have represented four facts F_1 to F_4. The facts F_1 and F_4 having in this example the same weights, the same value V_1 corresponds to them. The facts F_2 and F_4 have different weights, and the values V_2 and V_4 respectively correspond to them. We denote by F^* the objective to be attained. Of course, as specified hereinabove, this objective does not belong to the base of facts, and it has therefore been represented outside of this base of facts. We have also represented the filters Ψ_1 (taking account of the objective) and Ψ_2 (taking account of the target), the intersection Φ of which is hatched. To the objective F^* there corresponds the value V^* which is the calculated value of the objective to be attained and which is situated in said intersection.

We note that if Ψ_1 and Ψ_2 are morphological openings, then $\Psi_1 \wedge \Psi_2$ is also an opening.

We write Val^{-1} for the inverse function which is defined by: $Val^{-1}(V) = \left\{ F \in \Im \,\middle|\, Val(F) = V \right\}$. The filter Ω on the base of facts is then defined by the following diagram:

$$\mathfrak{I} \xrightarrow{\quad Val \quad} \left\{ Val(F) \mid F \in \mathfrak{I} \right\}$$

$$\Omega \downarrow \qquad\qquad \downarrow \Phi = \Psi_1 \wedge \Psi_2$$

$$\overline{\mathfrak{I}} \xleftarrow{\quad Val^{-1} \quad} \left\{ V \mid d(V, V^{\#}) \leq d(V^{*}, V^{\#}) \text{ and } d(V, V^{*}) \leq d(V^{*}, V^{\#}) \right\}$$

In this diagram, the valuation function *Val* makes it possible to obtain the value of the fact F (which fact is part of the base of facts $\mathfrak{I}$) for each fact of the base. After filtering by Φ, we obtain the degree of importance *v* corresponding to the fact F, and by applying the inverse function Val^{-1}, we obtain the filtered base of facts $\overline{\mathfrak{I}}$. By construction we clearly have $\overline{\mathfrak{I}} \subset \mathfrak{I}$; as Φ is idempotent, we have for Ω the operator which makes it possible to filter the base $\mathfrak{I}$ to obtain $\overline{\mathfrak{I}}$:

$$\Omega \circ \Omega = (Val^{-1} \circ \Phi \circ Val) \circ (Val^{-1} \circ \Phi \circ Val)$$

$$= Val^{-1} \circ \Phi \circ (Val \circ Val^{-1}) \circ \Phi \circ Val$$

$$= Val^{-1} \circ (\Phi \circ \Phi) \circ Val$$

$$= Val^{-1} \circ \Phi \circ Val$$

$$= \Omega$$

Ω is therefore idempotent and relation (1), monotonicity, is true by construction.

The implementation of the method of the invention will be illustrated with the aid of a very simplified example.

According to this example, we need to construct a line of argument on the basis of the following data:

- the target audience is a fictitious population class B,

- the objective consists in convincing the audience of class B that the fictitious class A of individuals is seeking confrontation with class A,

- the values of the audience are the universal Schwartz values, well known in the field of psychology. These values are weighted as a function of the importance that class B may accord to them. Each weight is a value v_i from the interval [0, 1]. The ten values V1 to V10 considered in the present example have the following weights respectively:

- Power	0.9
- Achievement	0.5
- Hedonism	0.95
- Stimulation	0.6
- Self-direction	0.9
- Benevolence	0.4
- Tradition	0.1
- Conformity	0.2
- Security	0.75
- Universalism	0.45

The information base consists of the following eight facts (F1 to F8), such as gleaned successively from a series of press releases, and which are weighted as charted in the table below:

F1: the American Congress authorizes President Bush to resort to force against Iraq

F2: thirteen attacks have been perpetrated in Corsica

F3: a member of class A has beaten to death a member of class B

F5: a Tchetchnian commando unit is holding 700 people hostage in Moscow

F6: class B has voted for the resumption of negotiations

F7: a strike notice has been issued by the employees of the Post Office

F8: the representative of class B has won prize XYZ

The weighting of the objective is as follows, for the same values V1 to V10: { 0.5 0 0 0 0 0 0 0 1 0 }

Thus, after morphological filtering, the method of the invention retains the following five facts:

F1: the American Congress authorizes President Bush to resort to force against Iraq

F2: thirteen attacks have been perpetrated in Corsica

F3: a member of class A has beaten to death a member of class B

F5: a Tchetchnian commando unit is holding 700 people hostage in Moscow

F6: class B has voted for the resumption of negotiations

The line of argument produced with the aid of these filtered facts is: "although class B has voted

for the resumption of negotiations, a member of class A has beaten to death a member of class B, but murder constitutes confrontation, hence class A is seeking confrontation".

5

Table of weighting of the facts F1 to F8

VALUE		WEIGHT									
		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
FACTS	F1	0.8	0.3	0	0	0.3	0.5	0.1	0	0.8	0.5
	F2	0.5	0	0	0	0	0.2	0.2	0	0.9	0.2
	F3	0.5	0	0	0.2	0	0.5	0	0	0.9	0.5
	F4	0.9	0	0	0	0	0	0	0	0	0
	F5	0.9	0	0	0	0.5	0.3	0.3	0.3	0.9	0.6
	F6	0.5	0	0	0	0	0.8	0	0	0.8	0.8
	F7	0.6	0.5	0	0	0.5	0.6	0	0	0	0.3
	F8	0.9	0.9	0.8	0.8	0.6	0	0	0	0	0